

Second Generation Weather Impacts Decision Aid User's Manual

**by Jim Brandt, Leelinda Dawson, Jeffrey Johnson, David Marlin,
Yasmina Raby, Richard Shirkey, Jeffrey Swanson, Richard Szymber,
and Subing Zeng**

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Army Research Laboratory

White Sands Missile Range, NM 88002-5501

ARL-TR-6620**September 2013**

Second Generation Weather Impacts Decision Aid User's Manual

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14. ABSTRACT This second generation (GEN II) user's guide provides an overview of the key functionality and capabilities of the web services and software applications. The My Weather Impacts Decision Aid (MyWIDA) provides weather impact information on military weapon systems and operations over space and time; Automated Impacts Routing (AIR) provides atmospheric impacts on platforms and alternative routing options considering adverse weather, no-fly zones, etc., along a planned path of movement. This is the second in GEN II series of reports. The first report is an overview and the third report will be a programmer's guide.					
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1. Introduction

Weather affects nearly everything that we do from determining whether we go to the beach or look for our umbrella. Army systems are no different: is the wind too strong for Unmanned Aerial Vehicles (UAVs) to be launched, is the ground frozen enough to support my tracked vehicle? These and a myriad of other system weather-related questions can be answered by the second generation's (GEN II) applications and web services. GEN II is comprised of My Weather Impacts Decision Aid (MyWIDA) version 2 (v2), a web-enabled, rules-based expert system based on thousands of identified weather sensitivities of Army, Air Force, Navy, and Marine systems and tactical operations. MyWIDA also incorporates the Automated Impacts Routing (AIR) system, which, when called by MyWIDA, calculates optimized routes in three-dimensional (3-D) space along a projected path avoiding adverse weather, no-fly zones, and other obstacles. Once a user has selected a weather forecast, MyWIDA automatically ingests that information, and then it classifies weather impacts on selected assets, for example, the RQ-6A Shadow UAV or the thermal sights on an M-1 A1 tank, as favorable, marginal, or unfavorable, for individual forecast grid cells (in MyWIDA, and throughout the rest of this report, the term "asset" will be used to apply to systems, subsystems, components, tactical operations, personnel, and equipment). This information is subsequently displayed as a stoplight overlay on a map of the area of interest. Although developed with Army assets in mind, MyWIDA and AIR are also applicable to key government decision makers and planners at all levels to more directly and automatically anticipate and understand the critical impacts and deleterious effects caused by major storms, severe/adverse weather, and hurricanes that affect resources, infrastructure, transportation, property, safety, and lives.

GEN II provides a user with a quick and easy means of determining adverse weather impacts on assets of interest. This user's guide provides an overview of how to request the required weather data, create, and view impacts for assets of interest and how to edit existing asset rules or create new assets. Installation and setup is straightforward and is explained in the appendix.

Note: Although GEN II refers specifically to web services and MyWIDA to the application, throughout this document we refer to GEN II/MyWIDA version 2 simply as MyWIDA. If, in any of the sections below, distinction between GEN II and MyWIDA is required, clarification is provided. Because AIR may be called by MyWIDA for path optimization, or it may be used as a stand-alone desktop application, it is discussed in a separate section of this document.

2. Weather Forecast Ingest/Obtaining an Organization ID

MyWIDA allows the user to select the source of the weather data used to generate impacts on assets through the Area Of Interest Service (AOIS)—the two options are the Air Force Weather Agency (AFWA) and the National Centers for Environmental Prediction (NCEP). Because AFWA is one of the military branches, the organization/agency that installs and manages MyWIDA must first apply for an account before attempting to pull data. To request an organization ID, send an email to Joint Meteorological and Oceanographic Broker Language (JMBL) support at JMBLSupport@offutt.af.mil stating that you have been provided the MyWIDA software from the U.S. Army Research Laboratory (ARL) and need to obtain an organization ID to allow you to order prognostic weather model data required to run the application. You will then receive detailed instructions regarding the information you will need to provide to AFWA to obtain the ID. No ID is required to obtain NCEP forecasts as the AOIS NCEP client takes care of this.

3. Rules

GEN II operates using Boolean logic, which organizes concepts together in sets controlled by use of the Boolean operators OR, AND, and NOT (GEN II does not use the NOT construct). Because GEN II allows users to create their own rule(s), they must follow the Boolean construct. This is the foundation by which all impacts are calculated.

Rules are the heart of GEN II, and they are specific to the asset(s) being investigated, for example, an RQ-6A Shadow cannot operate at wind speeds over 30 kt.* Each asset may have multiple rules, which are OR'ed together, and each rule may have multiple clauses, which are AND'ed together. For example, a rule could have only one clause, as in (temperature > 100°) or a rule might have more than one clause, as in (temperature > 100° AND pressure < 14 mb). Whether or not a rule contains one or multiple clauses, all rules for an asset are “OR'ed” together for each individual grid cell, that is, continuing the example above, impacts rules might be stated as (temperature > 100° AND pressure < 14 mb) OR (wind speed > 38 kt); two rules, one with two clauses.

Legacy Integrated Weather Effects Decision Aid (IWEDA) rules (no longer supported/updated and now replaced with milSuite rules, described below) are located in the Centralized Rules Repository (CRR) on Army Knowledge Online (AKO). The CRR contains military and

* Due to the sensitivity of rule thresholds, the values presented here and throughout this document should not be taken as operationally correct or associated with any particular system.

civilian rules: the original Centralized Rules Data Base (CRDB) and an Excel version that contains a slimmed-down rule set (those fields that have been found to be irrelevant have been omitted). Although MyWIDA uses rules in Excel (.xls), as well as semicolon-separated American Standard Code for Information Interchange (ASCII format), the CRDB format has been kept for users of legacy IWEDA.

3.1 Importing Rules From the Rules Repository

MyWIDA can be supplied with default Air Force, Army, and Navy rule sets obtained from the Distributed Common Ground System-Army's (DCGS-A's) CRDB, recently hosted on milSuite. Contact Ms. Mona Mikkelsen, U.S. Army Training and Doctrine Command (TRADOC) Capability Manager (TCM) for access to the DCGS-A CRDB, at mona.mikkelsen@us.army.mil. For information on the unsupported legacy rule set, described earlier in this document, contact Mr. Jeff Swanson, ARL, at jeffrey.s.swanson6.civ@mail.mil.

3.2 User-Supplied Rules

The user of MyWIDA v2 can supply their own set of (user-defined) rules that they can create and modify themselves in an Excel or ASCII format, as described previously. The use of an Excel file will be described here. First, the user creates an Excel file for the rules (a template is supplied). Each row in the spreadsheet holds information on an asset's individual rules or clauses with MyWIDA, determining the contents of a column by parsing the header (row 0). In the example in table 1, the first column defines the asset name (e.g., AH-64). The second column contains the rule ID number (i.e., 1, 2, 3, etc.), which can be any number and in any order and is needed to identify specific rules and clauses for an asset—if a rule has more than one clause, the rule ID is repeated as in rows 4 and 5, and 6 and 7. The third column is for the impact code (i.e., 1 for a marginal impact and 2 for an unfavorable impact). The fourth column contains the meteorological parameter name (e.g., temperatureAir). The fifth column contains the critical threshold value (e.g., 100). The sixth column lists the mathematical operator (e.g., >) and the seventh column contains the parameter units (e.g., °F). The impact code, parameter name, operator, and units all have dropdown menus in the Excel template.

Table 1. An example of a user-supplied rules (Excel) file for an Army helicopter.

Row No. ^a	Asset Name	Rule ID	Impact Code	Parameter Name	Critical Value	Operator ^b	Units
1	AH-64	1	1	temperatureAir	100	>=	°F
2	AH-64	2	2	thunderstormProbability	50	>	percent
3	AH-64	3	2	weatherRainFlag	2	>	code
4	AH-64	4	1	icingIntensity	2	>	code
5	AH-64	4	1	geopotentialHeight	10,000	<	feet
6	AH-64	5	2	geopotentialHeight	10,000	<	feet
7	AH-64	5	2	icingIntensity	3	>	code
8	AH-64	6	1	turbulenceIntensity	1	>	code
9	AH-64	8	2	windSpeed	45	>=	knots

^a This column is for illustrative purposes only and is not, nor should it be, included in the Excel file.

^b For (greater than) or (less than) and equal (\geq , \leq), separate contiguous symbols must be used, for example, \geq or \leq .

Summarizing, (recall that because the input file is parsed by MyWIDA, the column order is irrelevant), the seven fields of required information that comprise a rule are (1) asset name, (2) rule ID number, (3) impact code, (4) master parameter name, (5) critical threshold value, (6) mathematical operator, and (7) parameter units.

Once the Excel spreadsheet and all clauses (a.k.a. rules) are completed, the user then names and saves the file locally; note the path where the file is saved and stored, so that it can be pointed to and retrieved by the MyWIDA v2 browser.

4. Area of Interest Web Client Application

The Area Of Interest web client application (AOI app) provides the interfaces for defining data orders, displaying the order summary and details. The initial startup of the AOI app is to call the application's Universal Resource Locator (URL) through the web browser:

http://<host_server_name>:8080/AOIWebApp. Only a registered user has the permission to use this application to request weather forecast data.

4.1 AOI App Login

On the first screen, the user will see an **AOI app Login** page as shown in figure 1, where the user enters their username and password, assigned by the AOI app administrator (the individual who controls MyWIDA within their organization and who has the privileges to create a user account).

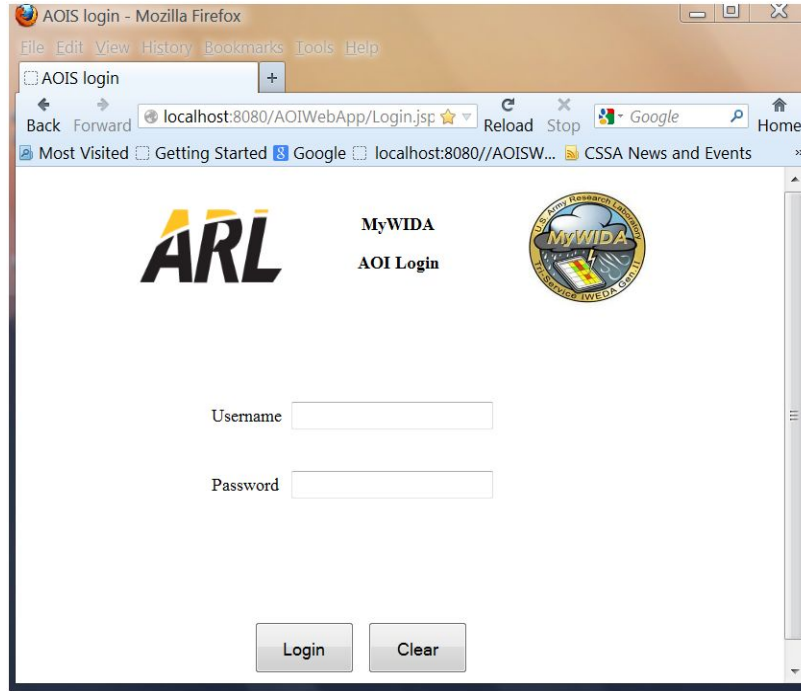


Figure 1. AOI app login.

Once logged in, the user will see the **AOI Orders** page, which is empty if the user has no order or has multiple entries if the user has existing orders as shown in figure 2.

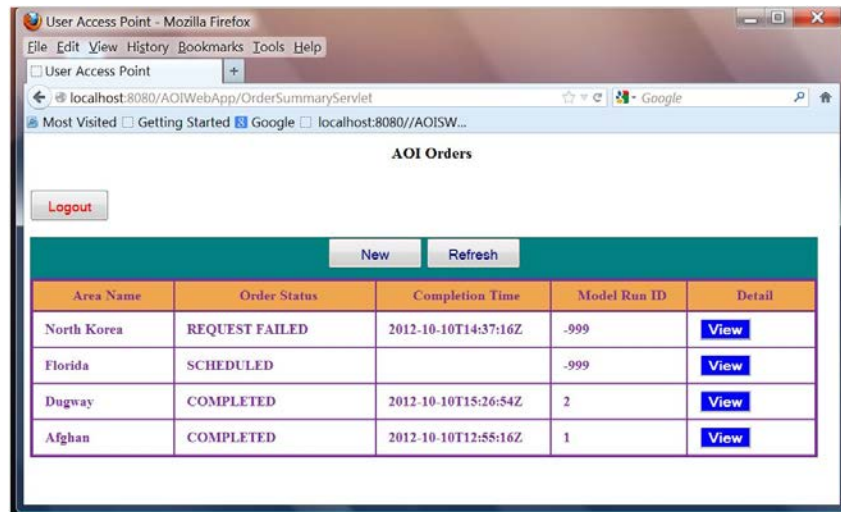


Figure 2. AOI orders.

4.2 AOI Orders

Addressing each entry item from left to right, the *Area Name* is the unique name to identify the user's particular order. The *Order Status* indicates the data request status with one of the following values:

- INITIALIZED—the order is placed into the UserOrder database.
- SCHEDULED—the order is placed in the queue awaiting execution.
- STARTED—the order has started.
- COMPLETED—the order has completed and data has been placed into the Gridded Meteorological Data Base (GMDB).
- REQUEST FAILED—the order failed in the data acquiring stage.
- DECODE FAILED—the order failed in the data decoding stage.
- POSTPROCESS FAILED—the order failed in the data postprocessing stage.

There are many factors that contribute to the failure of an order. The “WeatherDataService.log,” a logging file located in a directory at the server where the AOIS job scheduler is installed, contains detailed information related to the cause of failure. When the user gets a failure order, he/she needs to contact the individual within their organization who controls MyWIDA and has the access privilege to the file “WeatherDataService.log,” so that this person can check the logging information and determine the cause of failure. ARL does not provide this service.

The *Complete Time* shows the completion time of this order process. The *Model Run ID* is the unique identification number from the GMDB for this order. The *View* button, under *Details*, displays order summary as shown in figure 2. The *New* button displays the **New Order** page (figure 3). The *Refresh* button (figure 2) shows the latest updates.

4.3 Defining New Order

Referencing figure 3 and addressing each entry item from top to bottom in the left panel, the *Area Name* is the first input, which uniquely identifies the user's order. The *Resource* provides the user a dropdown list with available weather data originating centers. The *Process Name* lists available forecast models related to the user-selected data center. The *Product* lists available data products related to the user-selected model (table 2 lists the process and associated products).

Figure 3. New order.

Table 2. Process and products.

Resource Center	Process/Model	Product	Base ReferenceTime (UTC)	Projection	Forecast Periods
AFWA	WRF	1	00, 06, 12, 18	Latitude/longitude $0.14 \times 0.14^\circ$	Start 0 End 72 Increments 3 (h)
		2	00, 06, 12, 18	Latitude/longitude 1.67×1.67 km	Start 0 End 72 Increments 3 (h)
		3	00, 06, 12, 18	Lambert conformal $0.4 \times 0.4^\circ$	Start 0 End 72 Increments 3 (h)
	GFS	1	00, 06, 12, 18	Latitude/longitude $0.5 \times 0.5^\circ$	Start 0 End 72 Increments 3 (h)
		2	00, 06, 12, 18	Latitude/longitude $1.0 \times 1.0^\circ$	Start 0 End 72 Increments 3 (h)
NCEP	GFS	1	00, 06, 12, 18	Latitude/longitude $0.5 \times 0.5^\circ$	Start 0 End 192 Increments 3 (h)
		2	00, 06, 12, 18	Latitude/longitude $1.0 \times 1.0^\circ$	Start: 0 End:192 Increments 3 (h)
		3	00, 06, 12, 18	Latitude/longitude $2.5 \times 2.5^\circ$	Start 0 End 192 Increments 6 (h)
		4	00, 06, 12, 18	Latitude/longitude $2.5 \times 2.5^\circ$	Start 204 End 384 Increments 12 (h)
DUGWAY	4DWX	1	00, 06, 12, 18	Latitude/longitude 1.0×1.0 km	Start 0 End 72 Increments 3 (h)
		2	00, 06, 12, 18	Latitude/longitude 3.3×3.3 km	Start 0 End 72 Increments 3 (h)
		3	00, 06, 12, 18	Latitude/longitude 1.1×1.1 km	Start 0 End 72 Increments 3 (h)

The next group of entries is for the Area of Interest (AOI) selection. The *Lower Left Latitude* and *Lower Left Longitude* input fields refer to the lower left corner of the box, and the *Upper Right Latitude* and *Upper Right Longitude* input fields refer to the upper right corner of the box where data will be requested.

The user can define the AOI in two ways. One is to enter the values in decimal degrees into above input fields, with positive/negative latitude values for the northern/southern hemisphere and positive/negative longitude values for the eastern/western hemisphere. The other is to click the *Select AOI* button, which pops up the **Map/AOI Selection** screen as shown in figure 4.

On the **Map/AOI Selection** page, place the mouse inside the map, hold it, drag the cursor left/right/up/down to navigate to the desired area, and then click two points. An AOI box will be generated over the map, and the latitude/longitude values of the lower left and upper right corners are automatically filled into the input fields underneath the map. If the user is satisfied with the selected AOI, click the *Done* button, which closes the **Map/AOI Selection** page and returns to the **New Order** page (figure 3).

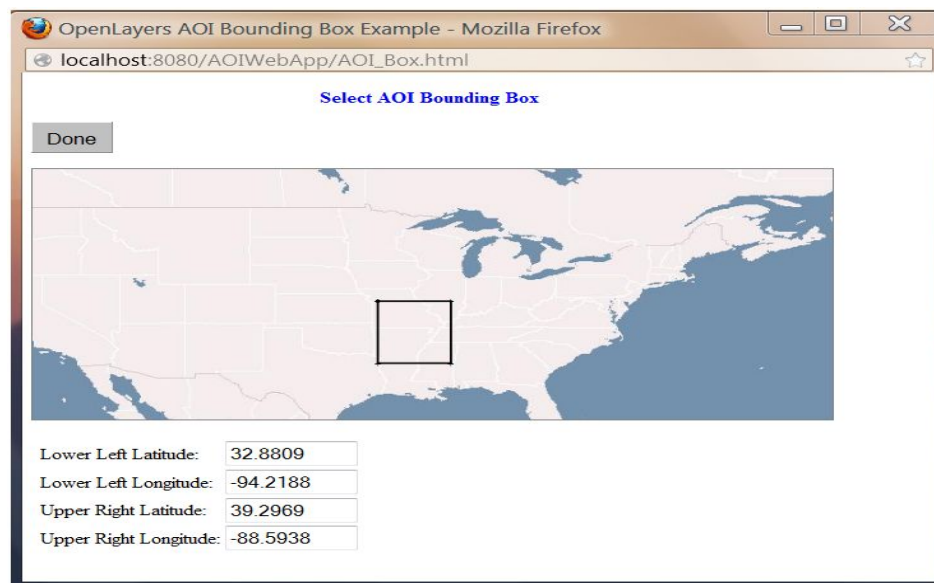


Figure 4. Map/AOI selection.

The next three fields, which are automatically filled in when a product is chosen, display the resolution/unit related to user-selected product. The *Row Resolution* and the *Column Resolution* refer to the horizontal resolutions in units of degrees, kilometers, or arcMinutes.

Turning now to the right panel and addressing each entry item from top to bottom, the *Base Reference Date* (YYYY-MM-DD) and the *Base Reference Time* refer to the beginning time for which forecast data should be retrieved.

The default date for an initial new order, shown on the *Base Reference Date*, is based on the computer system time. If a different date is wanted, click on this field to bring up a calendar date picker, and then pick the desired date from the calendar.

Then select from the pulldown Base Reference Time menu. Most models start at times based on Coordinated Universal Time (UTC) or Zulu time (Z) with the selections being 00:00, 06:00, 12:00, and 18:00.

Next, select an item from the pulldown menus from the *First Forecast Period*, the *Increments*, and the *Last Forecast Period*. Note that the periods and intervals are in hours, starting from the *Base Reference Time*.

The next group of fields refers to the *Job Start Date/Time (UTC)*. Check the box *Now* if the data request is needed immediately and for one time only. Otherwise, uncheck the box *Now* and provide inputs for the *Date*, the *Hour*, and the *Minute*, so that the data request is made based on this specific date/time. Because forecasts closer to the time of interest are more accurate, the user may want to produce a forecast at a later time, closer to the time of an operation.

The default time shown on the *Date/Hour/Minute* is based on the computer system time. If a different date is wanted, click on the *Date* to bring up a calendar date picker, and then pick the desired date from the calendar. If a different hour/minute is wanted, click the up/down arrow next to the *Hour/Minute* field to increase/decrease the value.

If the *Recurring Yes* is selected, the data request will be made daily at this specific hour and minute, otherwise, the data request will be made for one time only.

If the user is satisfied with all of the inputs, click the *Save* button at the top of the page to save this newly created order. The **AOI Orders** page (figure 2) shows up subsequently with this new order, with INITIALIZED for the *Order Status* and -999 for the *Model Run ID*. When the job scheduler sees this new order, it will place it into the execution queue and update its order status to SCHEDULED. Click the *Refresh* button in the **AOI Orders** page to get the latest order updates.

If the user is not satisfied with the inputs, click the *Cancel* button. The inputs will be abandoned and the user is directed back to the **AOI Orders** page. Note that the **New Order** screen is for capturing a new order specification or requirements, not for a failed order resubmission (as might be done for the North Korea data in figure 2. This would require a new order.

4.4 Order Summary

The **Order Summary** page displays order specifics for a particular order as shown in figure 5.

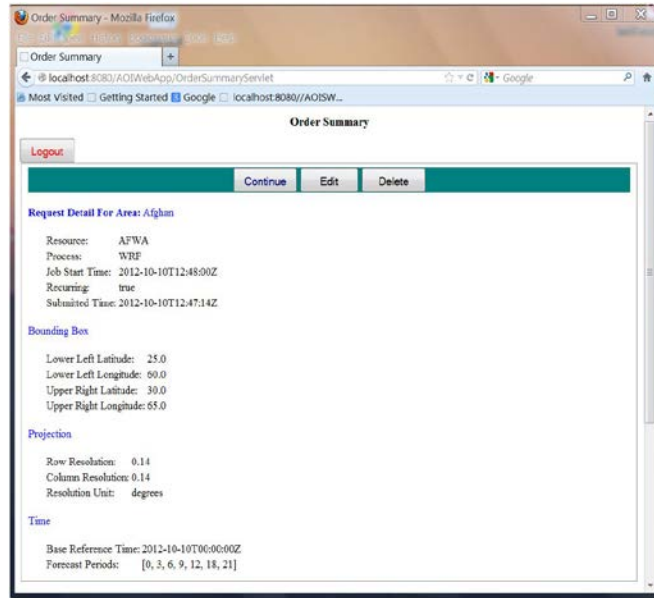


Figure 5. Order summary.

Click the *Delete* button at the top of the page to remove this order. Click the *Edit* button to bring up the **Update Order** page as shown in figure 6. This page is similar to the initial **New Order** page (figure 3), except that it already populates each entry with the previous value of the order. Clicking the *Continue* button will return to the **AOI Orders** page as shown in figure 2.

4.5 Updating Order

The user can modify all the entries except the value of *Area Name*. Note that in figure 2, the North Korea data order failed; this order requests an updated time/date as shown in figure 6.

Figure 6. Update order.

5. MyWIDA: a Reference Implementation

The complete MyWIDA application is provided as a Java Application Programming Interface (API), in order to facilitate embedding into other applications, as well as incorporation of custom interfaces. To make MyWIDA immediately available, a web implementation is also provided, using the javax.servlet.http package. In addition to the servlet, which is deployed on an application server, two client browser versions have been developed. Both use the same application server and therefore provide identical results. The step-by-step instructions for the Hypertext Markup Language (HTML) version are given in the following sections; instructions for the Adobe Flex^{*} version may be found in the appendix.

Both versions use the CRDB's rules. This Excel rule file must reside on the user's computer with its location determined by the user. For formatting and other information relevant to rules, the user should carefully read section 3 of this report.

Both versions of the MyWIDA app can be viewed in 3-D using Google Earth. Note that this is a standard installation of Google Earth, which must be available on the PC independently of MyWIDA.

This version of MyWIDA will run on the Firefox browser without the use of any add-ons. It requires only that javascript be enabled. It is accessed via the URL http://host_server_name:8080/MyWida.

5.1 Initial Display

The initial screen presented to the user is shown in figure 7.

The display is divided into four sections. Counterclockwise from the upper left they are *Menu*, *Weather Effects Matrix (WEM)*, *Information*, and *Map*.

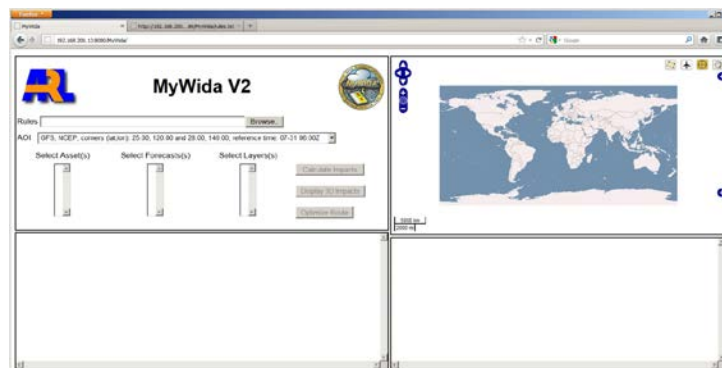


Figure 7. The MyWIDA client application display after initialization. MyWIDA is now ready for use.

^{*} Adobe Flex is a registered trademark of Adobe Systems Incorporated.

The Map section, discussed in more detail below, contains several display controls. The upper right icons represent different modes in which the display can operate. The right-most button, showing a hand, enables the user to drag the map around the window. The next button, showing a viewfinder reticule, allows the user to select a map point. This mode is enabled, as shown by the yellow shading, by default.

Notice within the Menu section that there are no assets, forecasts, or layers available for selection, and the *Calculate Impacts*, *Display 3D Impacts*, and *Optimize Route* buttons are disabled. Before MyWIDA can calculate any impacts, the user must upload a rule file and select a forecast model.

5.2 Rule File Selection

Rules are uploaded using the *Rules* file selection field at the top of the Menu section. This field invokes a browser file selection menu from which the user can select any appropriate rule file from the user's PC (figure 8). Note that once the rule file has been uploaded, a list of assets will be visible in the **Select Assets** window below the **AOI** window (figure 9).

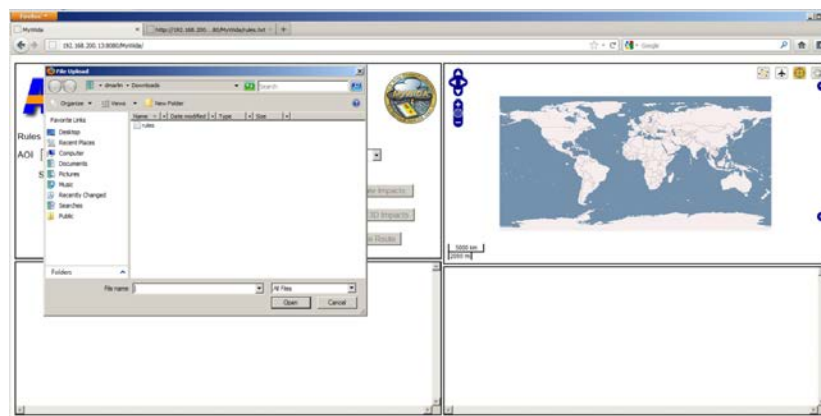


Figure 8. The Menu section showing the standard Firefox file upload window requesting the user to select a rule file.

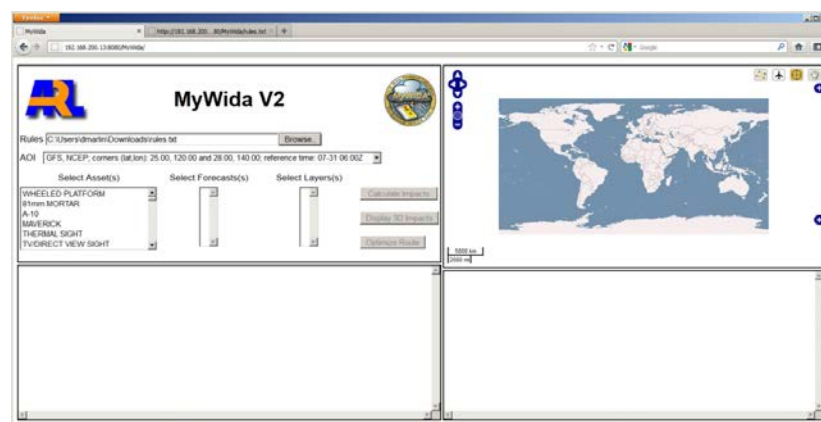


Figure 9. The Menu section showing the selected rule file and available assets.

5.3 Area of Interest Selection

An AOI and its associated forecast model is selected using the AOI selector (figure 10), located immediately below the **Rules** window. This selector is automatically populated with a list of all available forecast models when MyWIDA is started.

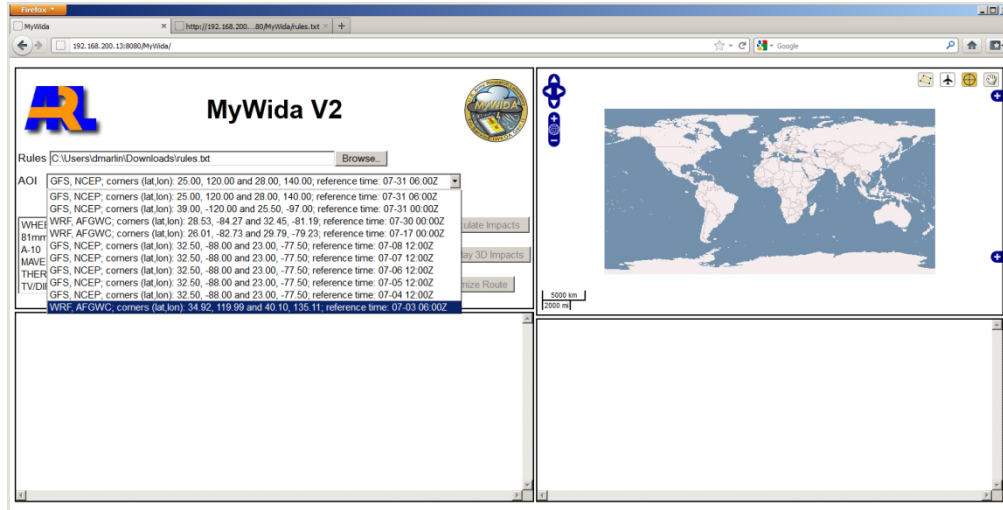


Figure 10. The Menu section shows the AOI drop-down menu listing all the available AOIs.

Once a forecast model has been selected, specific forecast periods and layers will be presented in the Select Forecasts and Select Layers dropdown menus (figure 11).

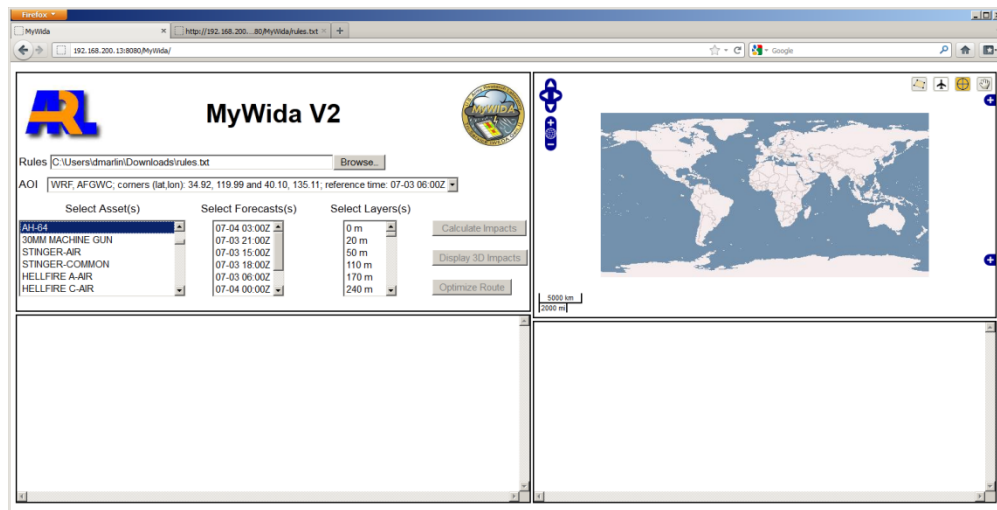


Figure 11. The Menu section showing a rule file downloaded and an AOI selected.
One asset has been selected, and forecasts and layers can now be selected.

5.4 Asset, Forecast, and Layer Selection

At this point, the user must select one or more assets, forecasts, and layers, using standard menu selection features: *ctrl click* to select multiple items and *shift click* to select a contiguous group of items (figure 12). Note that the *Calculate Impacts* button is now enabled. This will be the case whenever one or more assets, forecasts, and layers have been selected. If a new rules file is uploaded or a new forecast model selected, the *Calculate Impacts* button will again be disabled until the user has selected assets, forecasts, and layers.

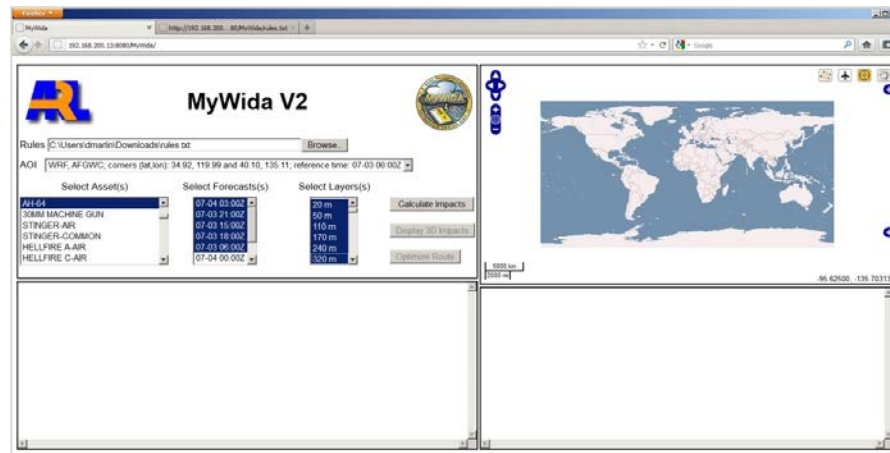


Figure 12. The Menu section showing selected assets, forecast periods, and layers.
Note that the *Calculate Impacts* button is now enabled, indicating that the server can now calculate impacts.

5.5 Impact Calculation

To initiate impact calculation, press the *Calculate Impacts* button. At that point, the browser will request that the MyWIDA server perform the calculations on the specified assets, forecasts, and layers. Once the calculations have been completed and returned to the browser, the impacts will be displayed in the WEM section of the display (figure 13).

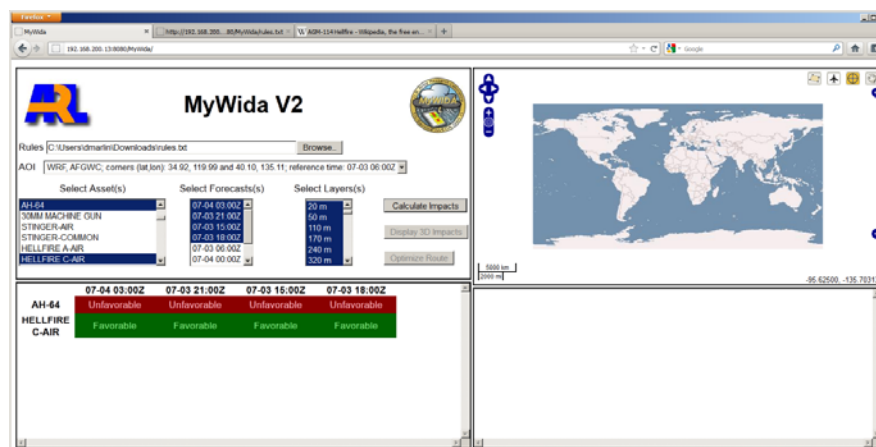


Figure 13. The WEM section in the lower left displaying the WEM for the selected assets, forecast periods, and layers.

For each asset and forecast period, the WEM will display the highest impact level found *across the complete forecast model AOI and among all the selected layers*.

5.6 Impact Map Overlays

To see the distribution of the impacts across the AOI, click on the *WEM* cell for the desired asset and forecast period. This will provide a map overlay in the Map section, depicting at each map point the highest impact among all the selected layers at that point. In figure 14, an impact map overlay is displayed in the Map section for the AH-64 asset and the 07-03 18:00Z forecast period.

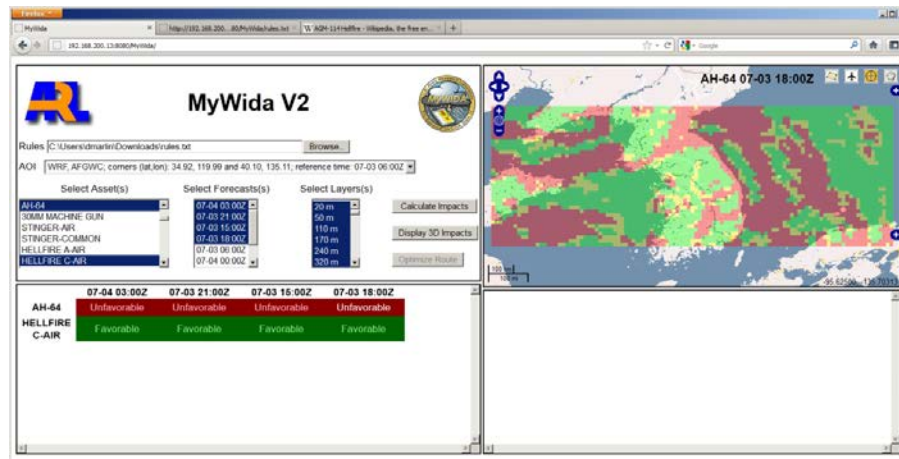


Figure 14. The Map section in the upper right displaying a 2-D impact overlay, representing the highest impact, among all selected layers, over each map location. The impacts are for the AH-64, 07-03 1800Z forecast period.

To see the impacts layer by layer at a given map location, click on that location in the Map section. A list of impacts, identified by layer, will then be displayed in the Information section (figure 15).

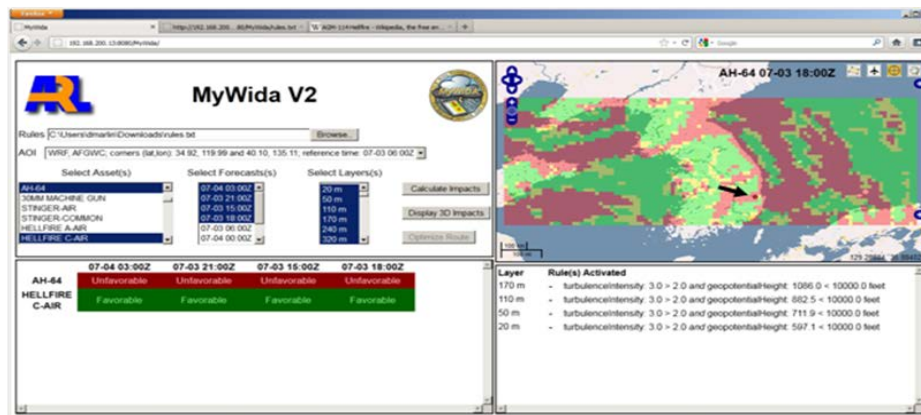


Figure 15. The Information section in the lower right displaying the impacts by layer for the selected map location, as indicated by the small black circle (denoted by the inserted arrow) near the lower central portion of the map.

Upon selection of an asset and forecast period, a full 3-D graphical representation of the impacts is also available, depicting individual impacts for each layer and map location. This is accessed using the *Display 3D Impacts* button in the Menu section, which will now be enabled. The 3-D display is actually provided by the server as a kml file, a common format recognized by many mapping programs and utilities, including Google Earth. The browser will provide a standard window giving the user the option to open the file with a specific application or save the file (figure 16).

Figures 17–19 show the 3-D impacts for the selected asset and forecast using Google Earth.

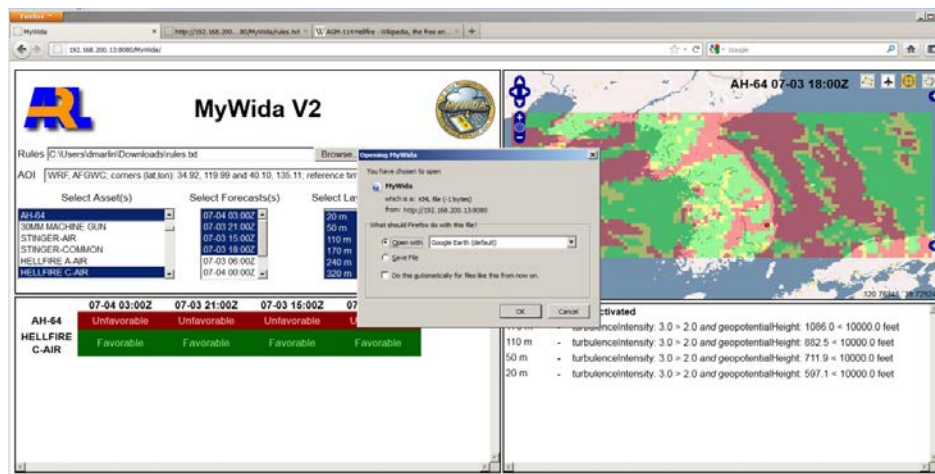


Figure 16. The standard Firefox file download menu, asking the user to open or save the 3-D graphics file returned by the server.

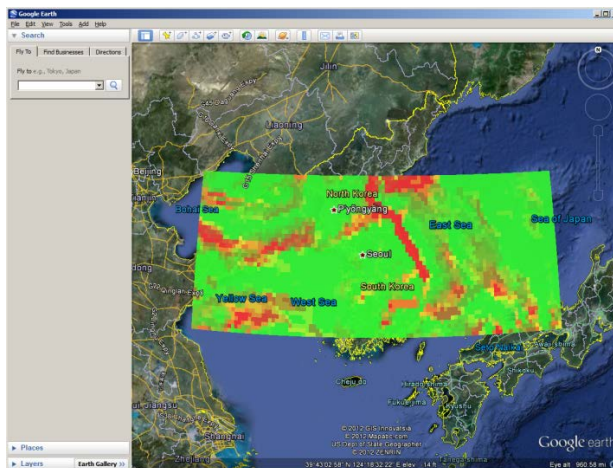


Figure 17. A “birds eye” view of the 3-D impacts, showing both layers. Note that the layers are semitransparent, resulting in various shades representing areas where the impacts at the two levels are different.

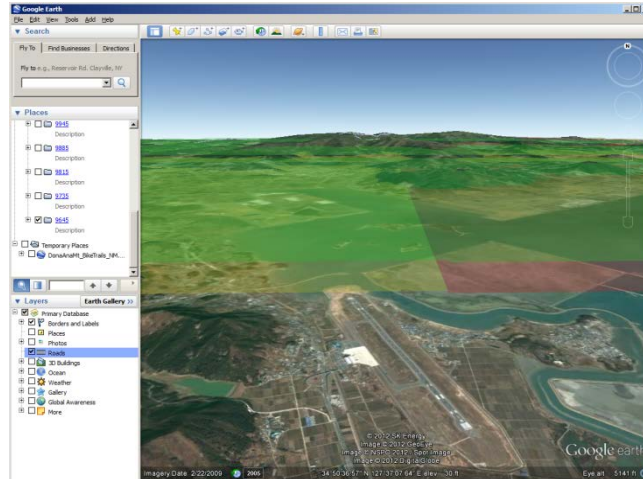


Figure 18. The 3-D impacts viewed from the edge of the AOI, just above both layers.

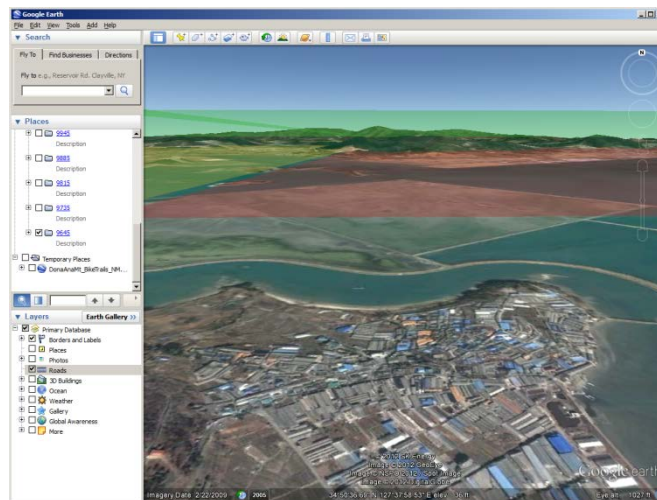


Figure 19. The 3-D impacts viewed from the edge of the AOI, between the two layers.

6. Automated Impacts Routing

The interface for automated routing in MyWIDA using AIR includes user inputs as follows:

- Two or more waypoints (decimal latitude, decimal longitude, altitude m mean sea level [MSL]).
- Platform speed (m/s) at each waypoint. This is the user-requested platform speed from the “current” waypoint to next waypoint.

- Risk level—Two choices are possible: less risk or more risk, with the “less risk” choice possibly being a longer route but encountering fewer adverse conditions. Conversely, the “more risk” choice may be shorter in length/time but at the cost of increased risk.
- Vertical boundaries (m MSL)—This is a coarse representation as model forecast levels can vary with height horizontally (i.e., they are terrain following). This method finds the approximate closest level to what the user requests and uses the entire level as a boundary. For precise bounding, AIR allows individual grid cells to be avoided, but the MyWIDA interface to support such is still to be determined.
- Include/exclude impact grid in Keyhole Markup Language (KML) output—AIR allows a KML “route only” output to be returned. In addition, a user may choose to include the entire set of impact grids that AIR used to determine its optimized path as part of the KML output. The latter output is useful should grid-cell resolution 3-D objects be defined as bounding objects as described above.

Figure 20 shows the AIR selection GUI in MyWIDA, with resulting output in a Google Earth display (bottom).

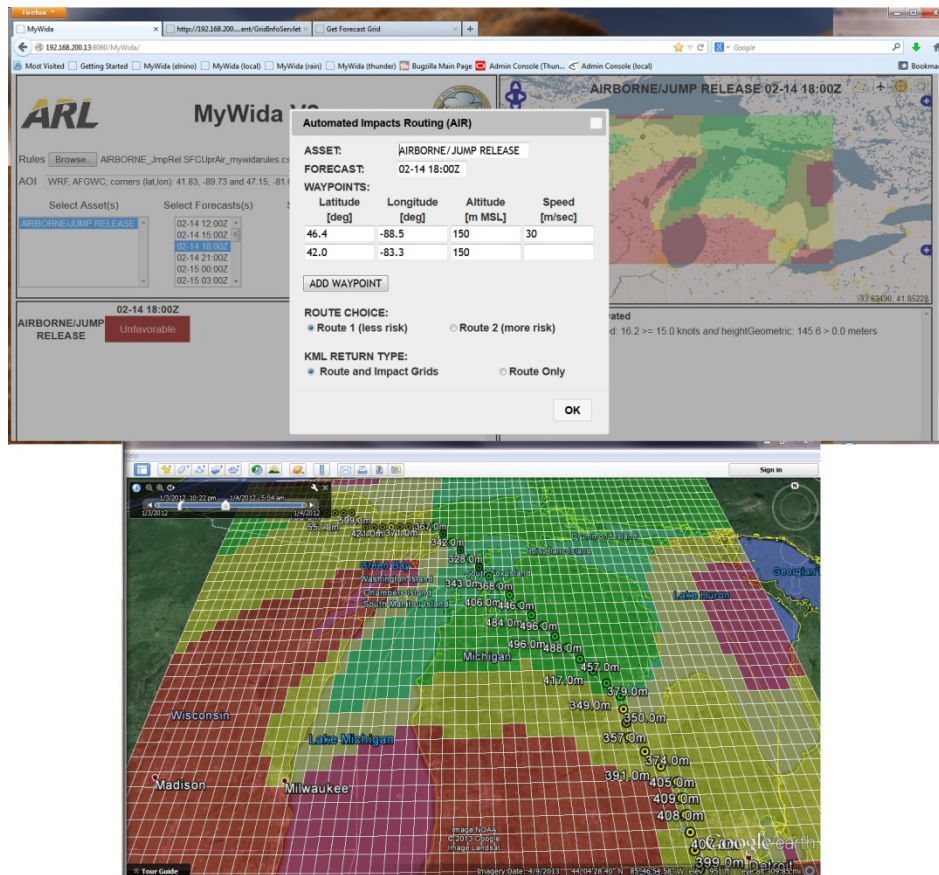


Figure 20. AIR selection in MyWIDA (top) with resulting Google Earth output (bottom).

7. Space Weather

Information about space weather is available through a button on either of the two reference applications. The button provides a link to the AFWA home page. AFWA has constructed a comprehensive web site for the effects and impacts of space weather effects on High Frequency (HF) communications, Ultra-High Frequency (UHF) Satellite Communications (SATCOM), satellite operations/health, space object tracking/satellite drag, high-altitude flight, and radar interference/anomalous returns.

7.1 Registration/Logon Procedure

The following is the registration procedure for Air Force Weather Web Services AFW-WEBS Space Weather page, which requires a Common Access Card (CAC) and a .mil address (for nonmilitary or noncivilian users see step 2 below):

1. Click on the following link: https://weather.af.mil/AFW_WEBS/.
2. If you are a first time user, click on the *Register* Button and complete the registration form to obtain an account using your CAC card. Your account has to be sponsored by a military or DOD civilian person, and the contact information of the sponsor is required during the registration process.
3. A confirmation email is sent to your email address. The notification of your registration status will be received by email within three duty days.
4. Once your account is approved, another set of emails are sent that contains your username and temporary password. Use the link in the email to change your temporary password.
5. Use the link from step 1 again using your CAC card. You should now be able to automatically login into the AFW-WEBS Space Weather web site.

Once you gain access click on the “space weather products” link under “Project Manager” on the home page which will take you to the space weather main page.

7.2 Available Space Weather Products

On the space weather main page, you will see the “Space Weather Events and Impacts Spotlight Chart.” That chart shows impacts for the following:

- Solar activity
- Charged particle environment
- Geomagnetic activity

- HF communications
- UHF SATCOM communications
- Satellite operations/health
- Space object tracking/satellite drag
- High-altitude flight
- Radar interference/anomalous returns

Many other charts and figures can be found on the AFWA/space weather web site to include the following:

- Daily indices: 7 and 30 day trend
- High-altitude radiation dosage chart
- Worldwide analysis of ionospheric conditions impacting HF propagation applications
- Worldwide 6 h forecast of ionospheric conditions impacting HF propagation applications
- Worldwide 6 h forecast of ionospheric conditions impacting UHF SATCOM applications
- Worldwide estimated GPS single-frequency error map two-dimensional (2-D) Nowcast
- Worldwide estimated GPS single-frequency error map 2-D forecast
- Worldwide auroral boundary

Tutorials, explanations of the above, and links to other web sites for space weather are also presented.

8. Dependencies

Table 3 presents the software versions required to successfully run MyWIDA v2.

Table 3. GEN II software dependencies.

Client	Software Name	Version
	Java Runtime Environment	1.6.0_45
	Firefox or Internet Explorer	22.0/ESR 17.0.7 9.0.13
	Google Earth	6.0.3 or greater
Server	Java Runtime Environment	1.6.0_45
	Java Development Kit	1.6.0_45
	Oracle Solaris Studio	12.3
	Glassfish	3.1
	HyperSQL (HSQLDB)	1.8.0.7

9. Summary

MyWIDA provides the commander with an easy-to-use and interpret tactical application that allows for near-real-time evaluation of sensor employment options. Automating the environmental parameter retrieval by using a prognostic data set further enhances the application and allows for realistic planning based on evolving weather.

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Appendix. Adobe Flex

This MyWIDA GUI was developed using Adobe Flex. It requires the Adobe Player plug-in to be installed and runs best in the Firefox web browser. The initial startup of the MyWIDA flex application is to call the application's URL through the web browser: `http://<host_server_name>:8080/MyWidaWebApp`. The application should appear with a successful initialization message as shown in figure A-1.

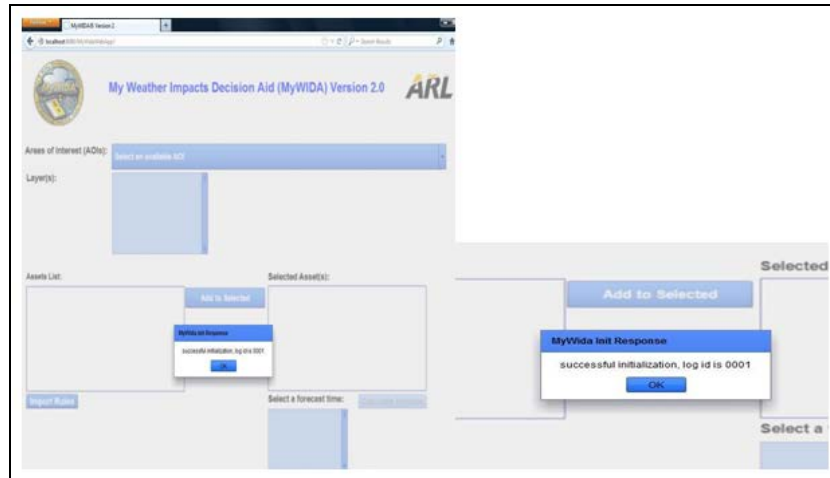


Figure A-1. MyWIDA Flex GUI Version 2.0—initial startup screen with inset.

A.1 Area of Interest and Layer Selection

The user selects an available AOI that resides in the GMDB from the AOI drop-down menu. The AOI drop-down menu lists all the information about each AOI, such as the latitude and longitude of the bounding box, forecast model, model resolution, and forecast periods as shown in figure A-2.

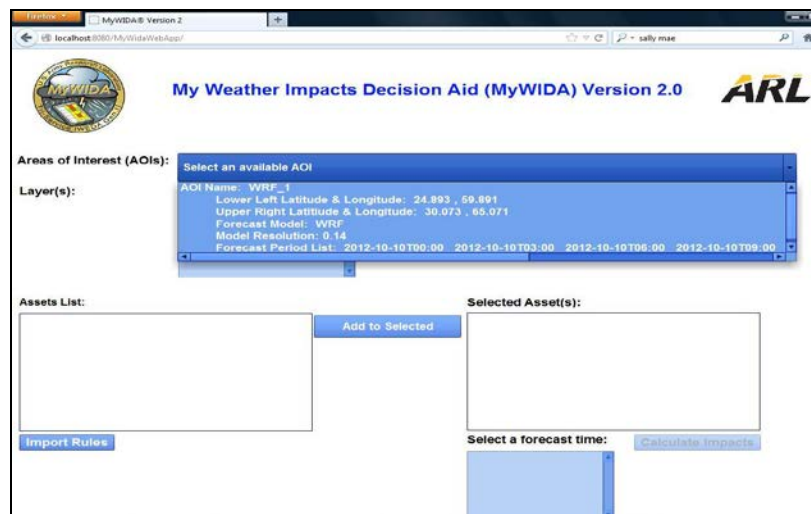


Figure A-2. Selecting an AOI using the AOI drop-down menu.

After the user selects an AOI, the layer and forecast time selector boxes are automatically populated based on the selected AOI. Then, the user can select one or more the available layers, which will be used in calculating the weather impacts. To select multiple items in the layer selection box, the user should use *ctrl click* to select each layer.

A.2. Rule File and Forecast Selection

The user clicks on the *Import Rules* button to import his or her local rules file into the web application by browsing and selecting it from the local computer's directory as shown in figure A-3. The *Assets List* box is automatically populated with the assets in the rule file. The user can choose one or more assets. Then, click on the *Add to Selected* button to move the assets to the *Selected Asset(s)* box. Next, the user selects the forecast times. Similar to the layer selection box, the user should use *ctrl click* to select multiple items in the *Assets List* and forecast time selection boxes.

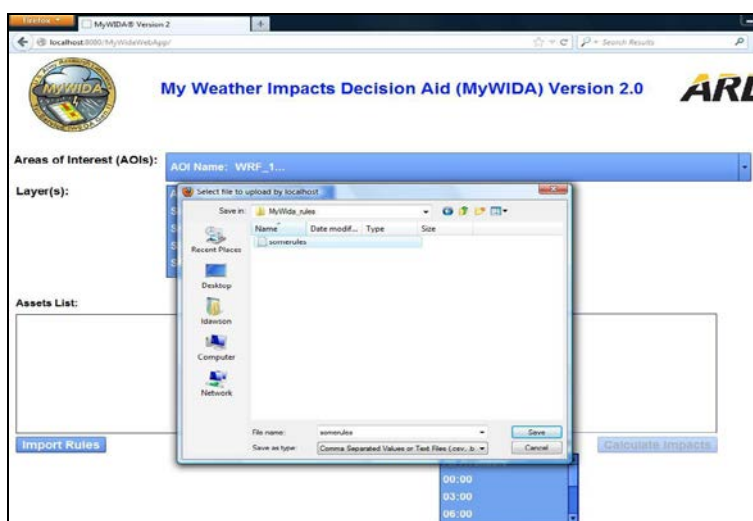


Figure A-3. Selecting and importing a local rules file.

A.3. Impact Calculation

After importing the rules file and selecting a forecast time, the user clicks on the *Calculate Impacts* button. This button becomes enabled after all the layers, assets, and forecasts have been selected. At this point, the browser will request that the MyWIDA server perform the calculations on the specified assets, forecasts, and layers. The WEM is automatically populated with the asset impacts associated with each forecast time. As shown in figure A-4, the WEM displays the weather impacts of the selected assets at each forecast period using the following severity codes: unfavorable (red), marginal (yellow), or favorable (green).

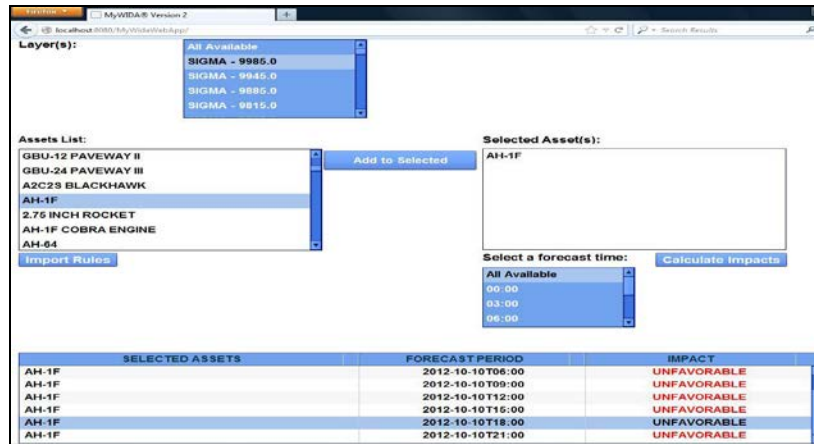


Figure A-4. WEM after selecting two layers, importing a local rules file, selecting an asset, and all the available forecast times

A.4 Impact Map Overlays

The map overlay of the impacts is shown in 2-D or in 3-D via Google Earth. To view the impact map overlay, the user must select a row in the WEM first and the 2-D map will be displayed in the box located under the WEM as shown in figure A-5. Note that if multiple layers are selected, the 2-D map overlay will show the layers as a “roll-up” of the highest impact color in each impact grid cell. The user can click in the cell and the exceeded threshold and forecast values will appear in the box under the 2-D map overlay. Note that this feature is only available in the 2-D map overlay.

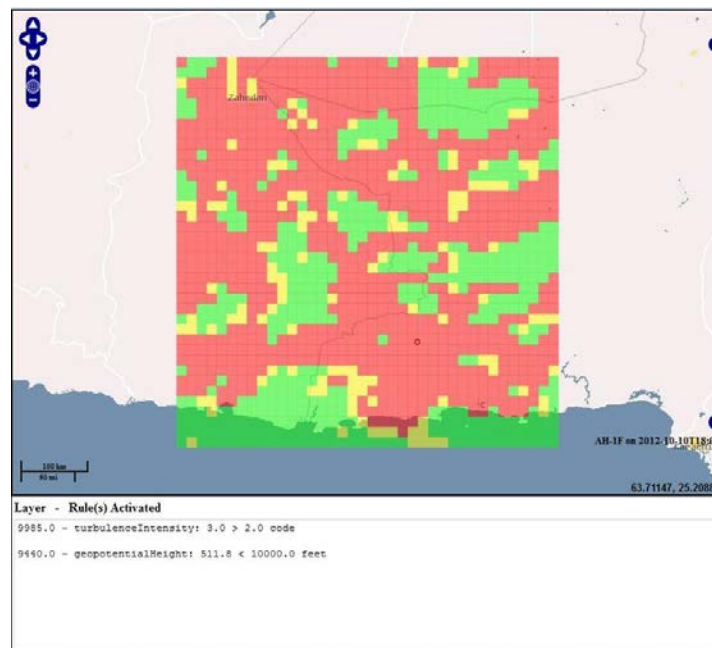


Figure A-5. 2-D impact map overlay after selecting a row cell from the WEM and clicking on an impact grid cell, showing the AOI with two layers.

The user also has the option to view the impact map overlay in 3-D by clicking on the *View 3D Impacts* button located under the WEM. Google Earth will display the overlay in 3-D as shown in figures A-6 and A-7. In 3-D, layers are displayed individually and can be toggled on or off.

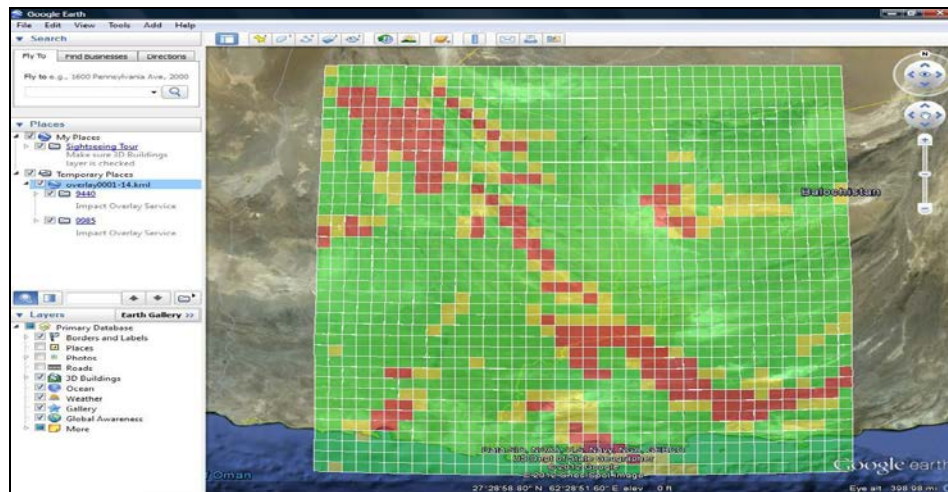


Figure A-6. 3-D impact map overlay via Google Earth after selecting a row cell in the WEM, showing a “birds-eye” view of the AOI with two layers.

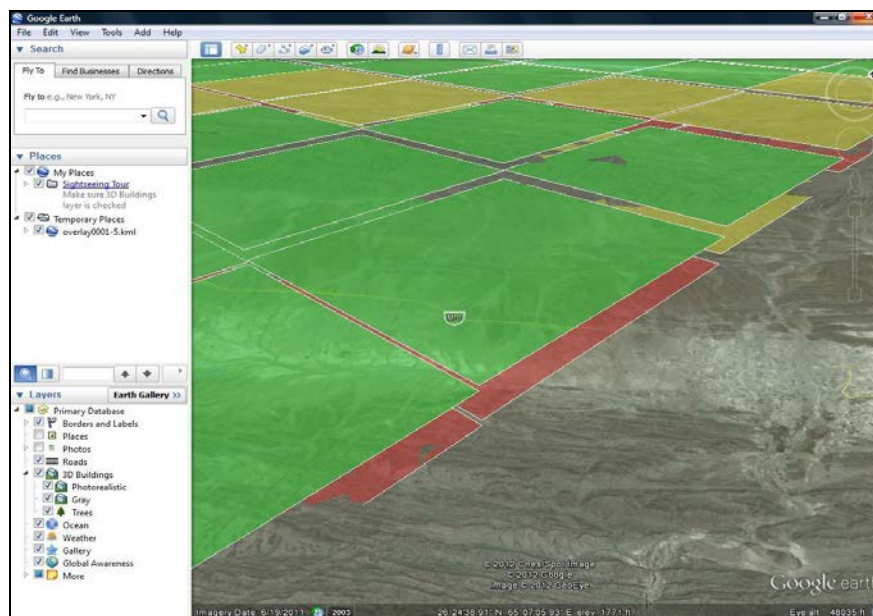


Figure A-7. 3-D Impact map overlay via Google Earth after selecting a row cell in the WEM, showing an edge view of the AOI between two layers.

A.5. Summary of Operations

The following provides a summary of the MyWIDA GUI operations and messages that might occur while performing these operations:

- **Initialize MyWIDA**—During the start up of the GUI, it opens the connection to all the MyWIDA web services. If successful, the GUI is initialized and returns a successful message dialog (see figure 20). Otherwise, an error message will appear, which most likely means that one or more of the required web services were not deployed on the server successfully.
- **Retrieve Areas Of Interest**—After the GUI is initialized correctly, data is returned about the available AOIs that are in the GMDB and then populates it into the AOI's pull-down menu, layer, and forecast time selector menus (see figure A-2). Otherwise, an error message will appear, which most likely means that the database server is not running or an error occurred in retrieving the AOI data from the GMDB. If the AOI pull-down menu is empty, this means that there is no data available in the GMDB, and the user should use the AOI app described in section 4 to order data to place in the GMDB.
- **Import Rules**—When the *Import Rules* button is clicked, a browse dialog appears that allows the user to import a local rules file. If successful, the assets of the imported rules are placed in the *Assets List* text area as shown in figure A-4. Otherwise, this means that the imported rules file is most likely invalid.
- **Calculate Impacts**—When the *Calculate Impacts* button is clicked, all the information concerning the selected AOI along with each specific layer, asset, and forecast period are used to calculate the weather impacts. The color-coded weather impacts for the selected assets at each forecast time are returned and populated into the WEM. If an error occurs, this most likely means that a layer, asset, or forecast time was not selected properly before clicking on the *Calculate Impacts* button.
- **Display 2-D or 3-D Map Overlay**—When a row cell in the WEM is clicked, a KML document depicting the impact overlay is returned to the GUI. The 2-D map overlay of the weather impacts is automatically shown for the selected asset and forecast time (see figure A-5) and the user can click on the *View 3D Impacts* button to view the 3-D map overlaid in Google Earth (see figures A-6 and A-7). If an error occurs, the user should make sure a WEM row cell is selected before generating a map overlay.
- **Retrieve Cell Impact Rules**—When an impact grid cell is clicked on the 2-D map overlay, information is returned about the layers and rules that were activated during the impact calculation at that specific grid cell. This information is shown in the box under the 2-D map overlay (see figure A-5). If there were no layers or rules activated at a particular cell location in the impact grid, a message will appear in the box.

If an error still occurs, the user should refer to the MyWida.log file located in the “config” directory of the server where the MyWIDA GUI and web services are deployed.

List of Symbols, Abbreviations, and Acronyms

2-D	two-dimensional
3-D	three-dimensional
AFWA	Air Force Weather Agency
AFW-WEBS	Air Force Weather Agency Web Services
AIR	Automated Impacts Routing
AKO	Army Knowledge Online
AOI	Area Of Interest
AOI app	Area Of Interest application
AOIS	Area Of Interest Service
API	Application Programming Interface
ARL	U.S. Army Research Laboratory
ASCII	American Standard Code for Information Interchange
CAC	Common Access Card
CRDB	Centralized Rules Data Base
CRR	Centralized Rules Repository
DCGS-A	Defense Common Ground System – Army
GEN II	second generation
GMDB	Gridded Meteorological Data Base
GUI	Graphical User Interface
HF	high frequency
HTML	Hypertext Markup Language
IWEDA	Integrated Weather Effects Decision Aid

JMBL	Joint Meteorological and Oceanographic Broker Language
KML	Keyhole Markup Language
MSL	mean sea level
MyWIDA	My Weather Impacts Decision Aid
NCEP	National Centers for Environmental Prediction
SATCOM	Satellite Communications
TCM	TRADOC Capability Manager
TRADOC	U.S. Army Training and Doctrine Command
UAV	Unmanned Aerial Vehicle
UHF	Ultra-High Frequency
URL	Universal Resource Locator
UTC	Coordinated Universal Time
v1	version one
v2	version two
WEM	Weather Effects Matrix
Z	Zulu time

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